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Project Summary for a Construction Permit Application from Aventine Renewable Energy, Inc. for a Dry Mill Ethanol Expansion Project in Pekin, Illinois

Site Identification No.: 179060ACR
Application No.: 05010062
Date Received: January 26, 2005

Schedule
Public Comment Period Begins: September 24, 2005
Public Comment Period Closes: October 24, 2005

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I. INTRODUCTION

Aventine Renewable Energy, Inc. (Aventine) performs corn wet milling and ethanol production at its existing complex in Pekin. Aventine has requested a construction permit to add a dry mill fuel ethanol facility with a nominal capacity of 56.5 million gallons per year to the complex to increase its overall ethanol production. The new facility would be served by the existing grain elevator, existing ethanol storage and loadout facilities at the complex. The new dry mill facility would include its own steam supply, which would be produced by the boiler integrated into the natural gas fired oxidizer serving the facility.

II. PROJECT DESCRIPTION

Aventine produces ethanol from corn by fermentation. The fuel ethanol is sold for use in gasoline. The complex also produces corn germ, yeast and feed as co-products and by-products from its milling and fermentation processes.

The proposed new facility would produce ethanol from whole corn received at Aventine's existing grain elevator. It would also yield feed as a by-product. There will be a number of distinct operations at the facility. First, corn is prepared for fermentation, by scalping (removing foreign matter), grinding, mixing with water, and cooking with enzymes that convert the starch in the corn into sugar. The resulting corn mash is then sent to the fermentation tanks for batch fermentation. Fabric filters are used to control the particulate matter (PM) emissions associated with handling of the dry corn. The exhausts from significant emission units used to prepare the wet mash, (i.e., the mixer, slurry tank, and yeast tank) are vented to the common oxidizer control system serving the new facility.

The new facility will have four fermentation tanks. The operation of the tanks is staggered so that while the fermentation process is being finished in one tank, another tank is being prepared to begin the fermentation process. Yeast is added to the corn mash in the fermentation tanks. The yeast breaks down the sugar in the corn mash into alcohols, primarily ethanol, and gaseous carbon dioxide (CO_2). Two different scrubbers are used to control emissions of ethanol and other organic compounds from the fermentation tanks. These scrubbers also control the emissions from the "beer well", a process tank that receives the content of each fermentation tank in turn and holds it pending further processing. The facility is designed so that the "wastewater" from the scrubbers is routed back to the mash preparation process for reuse, ideally minimizing any flows of process wastewater for the facility.

The first scrubber is the fermentation scrubber, which is also referred to as the "CO_2 scrubber" as it scrubs the CO_2 rich stream from fermentation. This scrubber normally controls emissions from tanks. The Permittee expects that the scrubbed CO_2 stream will then be sold to the CO_2 processing plants adjacent to the complex. These plants, which are not owned by Aventine, operate under long-term contract with Aventine, to purchase and then process the CO_2 for resale.

The second scrubber for the fermentation operations is the purge scrubber. The purge scrubber is used for control of the exhaust from a fermentation tank or the beer well when it is being cleaned or purged between batches, when air may also be present in the exhaust stream.

The ethanol-laden beer temporarily held in the 'beer well" is processed to separate the ethanol, water, and remaining solids. The ethanol is separated from the beer in a two-step distillation process to produce 190 proof ethanol (95 percent ethanol/5 percent water). The ethanol is further purified in a molecular sieve to 200 proof (100 percent ethanol). The exhaust from these distillation processes is also vented to the oxidizer system for control of organic emissions.

After being denatured with gasoline, the 200 proof ethanol will be stored in existing tanks at the complex prior to bulk load out and shipping by truck, rail or barge. The emissions from the storage of the fuel ethanol are minimized by use of floating roof tanks, which prevent loss of vapor to the atmosphere. The load out of ethanol is a source of emissions due to the organic vapors displaced from the tank truck, rail cars or barge during loading. For loading of rail cars and barges, loadout emissions are minimized by submerged loading and use of dedicated rail cars and barges, which previously handled ethanol. For loading of tanks trucks, which are not in dedicated service and may have previously transported gasoline so as to be laden with gasoline vapors, emission are controlled with a vapor combustion unit.

Valves, pumps, flanges and other components of the piping involved in fermentation, distillation, and storage and handling of material are a source organic emissions when they leak. These emissions will be minimized with a Leak Detection and Repair (LDAR) Program, which requires regular inspections of component for leaks and timely repairs of any leaking components.

The solids-rich material recovered from the bottom of the beer still (the first still in the distillation process) is the source of the by-product feed produced by the facility. The material is first mechanically processed by centrifuges to remove water from the material, to produce "wet cake". The recovered water from the centrifuges is processed in steam driven evaporators to drive off water, to produce "thick syrup". The syrup from the evaporators is mixed with the wet cake from the centrifuges and further processed by drying to produce dry feed.

Two natural gas fired dryers will be sized to dry all wet cake made at the proposed facility. Dried feed can be shipped long distances and stored for long periods of time, as compared to wet cake which must be shipped and used in a period of time measured in days. The dryers are equipped with cyclones for minimize loss of feed material as PM emissions to the natural gas-fired oxidizer system that controls emissions of organic material, carbon monoxide (CO), and PM from the dryers. The oxidizer also functions as the combustion furnace for the boiler that supplies steam to the proposed facility.

After drying, the feed is cooled as it is conveyed to the feed storage area prior to load out and shipping. The PM emissions from these operations involving dried feed are controlled by two baghouses, one for the cooling and transfer operation and the other for handling of feed in the storage area.

A cooling tower would be used to supply cool water to the heat exchangers at the facility that are used to cool certain process streams and to condense any surplus steam returning to the boiler.

Emissions from the tower are controlled by a high-efficiency mist eliminator that minimizes loss of water droplets.

Emissions of fugitive dust are generated by vehicle traffic and wind blown dust on roadways, parking lots and other open areas at the plant. These emissions will be minimized by paving of new roadways and the parking lots for the new facility and by an ongoing Fugitive Dust Control Program.

III. PROJECT EMISSIONS

The potential or permitted annual emissions of this project, as would be allowed by the draft permit, are summarized below. Actual emissions will be less than the permitted emissions to the extent that the facility would operate at less than its maximum capacity and control equipment normally operates to achieve emission rates that are lower than the applicable standards and limitations.

Permitted Annual Emissions of the Project (Tons/Year)

	PM[a]	VOM	SO_2	NO_x	CO	Indiv. HAP	Aggr. HAP
Dry Mill Facility	34.3	94.4	37.3	54.8	96.2	9.5	23.5
Existing Facilities[b]	11.4	23.0	--	--	--		
Total:	45.7	117.4	37.3	54.8	96.2		

Notes:
a. Particulate matter (PM) including condensable particulate as measured by USEPA Method 202.
b. Increase in emissions associated with this project at existing facilities.

IV. APPLICABLE EMISSION STANDARDS

The application shows that the proposed project will readily comply with applicable state and federal emission standards, including the emission standards and regulations of the State of Illinois (35 Ill. Adm. Code: Subtitle B) and applicable federal emission standards adopted by the United States EPA (40 CFR Part 60).

For purposes of designating applicable emission standards, the oxidizer/boiler control system has been considered a boiler or steam generating unit even though it also serves as air pollution control equipment. This is because it meets the applicable regulatory definitions of a steam generating unit. In addition, as the oxidizer/boiler functions as the source of steam to the dry mill facility, it is essential to various processes that are conducted at the facility to convert corn into ethanol.

V. PREVENTION OF SIGNIFICANT DETERIORATION (PSD)

The proposed project is considered a major project under the federal rules for Prevention of Significant Deterioration (PSD), 40 CFR 52.21, for emissions of particulate matter (PM), volatile organic material (VOM), and nitrogen oxides (NOx). The Illinois EPA has been delegated authority by the United States EPA to administer the federal PSD program in Illinois. These rules are relevant for these pollutants because the Aventine complex is located in a region whose air quality

is classified as attainment for particulate matter, ozone, and nitrogen dioxide, as well as for other criteria air pollutants.

Because the existing Aventine complex is already a major source of emissions, the criterion for whether the proposed project is considered major is whether the permitted emissions of the project for one or more pollutants regulated by PSD would qualify as significant, as defined by the PSD rules. The project meets this criterion for PM, VOM and NOx, with permitted annual emissions that are greater than 15, 40 and 40 tons, respectively. The project is therefore subject to the certain substantive requirements of the PSD rules for these pollutants. The permitted annual emission of carbon monoxide (CO) and sulfur dioxide (SO_2) associated with the project are less than and 100 and 40 tons, respectively. Therefore, this project is not subject to PSD for these pollutants.

The substantive requirement of the PSD rules for a major project for a pollutant are: 1) A case-by-case determination of Best Available Control Technology (BACT), 2) An ambient air quality impact analysis to confirm that the project would cause or contribute to a violation of the National Ambient Air Quality Standard(s) (NAAQS) or applicable PSD increment(s); and 3) An assessment of the impacts on soils, vegetation and visibility.

A. BEST AVAILABLE CONTROL TECHNOLOGY (BACT)

Aventine submitted a BACT demonstration in its application reflecting its judgment as to the emission control technology and associated emission limits that should be considered BACT under the PSD rules for various units at the new facility. This demonstration addressed the units at the new facility as the BACT requirement of the PSD rules does not apply to existing units that are not being modified.

The Illinois EPA has reviewed the material submitted by Aventine and made its independent determination of BACT. In addition to the material submitted by Aventine, the Illinois EPA's determination of BACT relies upon its general knowledge of the types of operations at the proposed plant and specific information about existing fuel ethanol plants and existing grain handling and processing plants that are located in Illinois. As explained below, the Illinois EPA concurred with Aventine's selection of control technologies as it reflected technologies that are in common use at ethanol plants and effectively control emissions. However, the Illinois EPA's determination of BACT the proposed facility, as set forth in the draft permit, would establish performance requirements for the control technology on certain units that are more stringent than those proposed by Aventine in its application.

Milling, Feed Cooling, and Feed Storage and Loadout

BACT reflects use of filtration-type control systems, also known as baghouses, for these units. Baghouses are routinely used for control of dust or PM emission in the exhaust stream from handling and mechanical processing of grain, feed and many other commodities.

For handling of grain and feed, BACT is appropriately set as a specification for the amount of filterable particulate that is in the exhaust stream from the baghouse, which is commonly expressed in terms of grains of PM per standard cubic foot of exhaust (gr/scf). BACT is proposed at 0.005 gr/scf, which represents an emission rate that is believed achievable for new baghouse systems in the types of dust service that would be present at the proposed plant.

For the feed cooling system, which emits measurable levels of VOM as well as PM, the BACT evaluation also considered a possible requirement for use of add-on control equipment for VOM emissions. However, the concentration of VOM in the exhaust stream from this unit is such that it is not amenable to cost-effective use of add-on control. Given the low concentration of VOM emissions and relatively large volume of the exhaust (greater than 20,000 actual cubic feet per minute), in addition to its capital costs, use of a scrubber would require large amounts of water, disrupting the water balance of the plant. Similarly, in addition to its capital costs, an oxidizer would use large amounts of natural gas, whose energy value could not be effectively recovered at the facility. Aventine's simplified cost-effectiveness evaluation of the equipment that would be needed for VOM emissions of this unit to be controlled indicates that the cost-effectiveness of such measures would be well in excess of $10,000/ton. Expressed in other terms, the VOM emission rate of the cooling system even without any VOM controls is still a fraction of the VOM emission rate of the feed dryers even after control by the oxidizer/boiler.

Fermentation

For the fermentation tanks and beer well, BACT reflects use of scrubbing with water for control of the emissions, which are composed of ethanol and other organic compounds. Scrubbers are commonly used for control of fermentation operations at ethanol plants, as they readily control ethanol and the other organic emissions that are generally soluble in water, and allow this material to be recovered in the process. Scrubbers can also be designed, as is planned at the proposed plant with both a CO_2 scrubber and a purge scrubber, to facilitate the effective recovery of the CO_2 from the fermentation process for further processing and sale.

Control requirements for CO_2 scrubbers have traditionally been set in terms of VOM control efficiency, e.g., 95 percent control. However, Aventine proposed a limit expressed in terms of pounds of VOM emitted per gallon of ethanol produced. As explained by Aventine, when performance of a scrubber on fermentation operations is tested, this approach reduces the significance of the level of "uncontrolled" emissions entering the scrubber, a parameter that varies over the fermentation cycle. Instead, performance can be more reliably evaluated comparing VOM emissions across the fermentation cycle to the overall ethanol production. Aventine's approach has merit and is used in the draft permit. It expresses the performance specification for BACT in a form, lb VOM/1,000 gallons of ethanol, that can be more readily compared project-to-project than control efficiency. It also allows a control requirement to be set that may be more

stringent than one expressed in terms of control efficiency, for which variability in uncontrolled emissions would have to be considered. For the CO_2 scrubber, BACT is proposed to be established at 1.2 lb VOM per 1,000 gallons of ethanol produced, with ethanol production determined in terms of equivalent denatured ethanol produced.

Incidentally, while emissions from fermentation would not occur from a stack at the proposed facility if the exhaust stream from the CO_2 scrubber were sent to a CO_2 plant for further processing, as anticipated by Aventine, the draft permit would hold Aventine "accountable" for emissions as this stream leaves the facility as if it were emitted to the atmosphere. This is a consequence of provisions of the PSD rules, which consider not only legal ownership of facilities but also functional and contractual relationships between facilities. As a result, a nearby facility that is linked with a "support facility" relationship cannot be treated as a separate and independent source under the PSD rules.

For the purge scrubber, a very different approach has been taken than for the CO_2 scrubber. This is because there is less information on which to set a BACT limit for the purge scrubber than for the CO_2 scrubber. In this regard, ethanol plants that are not associated with CO_2 plants do not require a purge scrubber. Depending upon the product made by a CO_2 plant, e.g., dry ice, industrial CO_2, or CO_2 for carbonated beverages, a separate purge scrubber may not be used even when the CO_2 from fermentation is being processed. Finally, even when a purge scrubber is present, attention would focus on the CO_2 scrubber, rather than the purge scrubber, which only operates intermittently to control emissions from one tank at a time when the tank is empty.

Accordingly, BACT is proposed with three alternatives, which would each reflect effective control of VOM emissions from the cleaning of the tanks between batches. The first alternative is effective control of VOM by the purge scrubber as demonstrated by a high water flow rate, i.e., 0.030 gallons/standard cubic foot of exhaust. The second alternative is again effective control by scrubbing, but as demonstrated by a high level of VOM control efficiency, i.e., 98 percent control. The third alternative is effective control of emissions, as demonstrated by a low concentration of VOM in the exhaust, i.e., 25 ppm. The numerical values selected for these alternatives are based on the demonstrated operation of CO_2 scrubbers. For example, the water flow rate reflects a value that is about twice the value of the water flow rate for a CO_2 scrubber that is operating to very effectively control VOM emissions from fermentation tanks.

Feed Drying

Combustion-type control, either by an oxidizer/boiler, regenerative thermal oxidizer, or other type of combustion device, is now recognized as an appropriate control technology for direct-fired feed dryers at ethanol plants. Combustion control is effective for control of the VOM, PM and CO emissions that are generated by the direct-fired feed drying process. As planned at the proposed facility, the combustion control system will also control the distillation process and several other VOM

emission units at the new facility, serving as add-on control for the controlled emission units other than the fermentation operations.

Like the scrubbers at ethanol plants, control requirements for combustion systems for feed dryers have traditionally been set in terms of VOM control efficiency, e.g., 95 percent control. However, this approach becomes less desirable as the complexity of the process streams controlled by the combustion system increase. In this case, the combustion control system will control two dryers, working in series, the distillation process, and various other emission units. Accordingly, the BACT performance requirement for the combustion system would generally be established in terms of the output of dry feed from the dryers, i.e., lb VOM/ton. This will again simplify the future comparison of the BACT limit for the proposed facility to limits being evaluated for other proposed projects, especially as some plants ship some feed as wet cake without drying. BACT is proposed to be established at 0.3 lb and 0.2 lb per ton of dried feed for VOM and PM, respectively. This is considered a stringent level of control based on the requirements and experience at other fuel ethanol plants.

Alternative work practice requirements are proposed for periods when the feed dryers are not operating, when the oxidizer/boiler is only being used for control of emissions of other units or only the oxidizer/boiler is operating.

For the oxidizer/boiler, BACT must also be established for the NOx emissions generated by the combustion of fuel in the device. For natural gas fired combustion equipment, emissions of NOx can be effectively controlled by low-NOx combustion technology. For the proposed facility, the BACT level of performance required of low-NOx technology is proposed to be established at 0.05 lb NOx per million Btu of fuel heat input. This is considered to be a stringent limit considering the arrangement of equipment at the facility, in which the combustion emissions of the two feed dryers exhaust through the oxidizer, which also serves as the boiler for the proposed facility. Because of this arrangement, the BACT limit for NOx is set as a single limit, relating the NOx emissions from the oxidizer/boiler to the total fuel heat input from both the burners in the two feed dryers and the burners in the oxidizer. This approach is necessary because it is not practical to distinguish the NOx emissions created in the dryers from those created in the oxidizer.

Distillation

For the distillation operations, Aventine has proposed control of VOM emissions with the oxidizer/boiler control system. This will provide effective control of emissions and the Illinois EPA has proposed to accept this as BACT. This avoids the need for a separate BACT determination for the distillation operations, as would be required if Aventine had proposed a separate control system for these operations.

Other Operations

For other operations at the proposed facility, use of add-on control equipment is not proposed as BACT. Instead, BACT is proposed as process design, equipment features, or work practices, as appropriate for specific operations to effectively minimize emissions from the operations. For example, VOM emissions of the stillage and syrup tanks are inherently low based on the nature of these materials. VOM emissions from the new storage tank are minimized by use of an internal floating roof with double seals. VOM emissions from leaking components are minimized by a formal Leak Detection and Repair Program

B. AIR QUALITY ANALYSIS

An ambient air quality analysis was conducted by a consulting firm, URS, on behalf of Aventine to assess the impact of the emissions of the proposed project. Under the PSD rules, this analysis must determine whether the proposed project will cause or contribute to a violation of any applicable air quality standard.

The air quality analyses for NOx and PM were performed using computerized dispersion modeling. The analyses conformed to the guidance and requirements of the USEPA and the Illinois EPA. The analyses indicate that this project will not cause a violation of the PM or NOx air quality standards or PSD increments. For NO_x, the predicted peak impact of the project is not significant, i.e., at most 0.44 micrograms per cubic meter ($\mu g/m^3$) annually compared to the standard of 100 $\mu g/m^3$. For PM, the project's peak impacts are at most 6.5 $\mu g/m^3$ annual average and 38.2 $\mu g/m^3$ 24-hour average, compared to the standards for PM10 of 50 $\mu g/m^3$ and 150 $\mu g/m^3$, respectively. The total consumption of PM10 increment predicted from this project and other increment consuming source is at most 7.1 $\mu g/m^3$ annual and 29.7 $\mu g/m^3$ 24 hour, compared to the PM10 increments of 17 $\mu g/m^3$ and 30 $\mu g/m^3$ respectively.

The analysis for PM, 24-hour average, which predicted the air quality impacts for each day from a collection of five years of daily weather data (over 1800 days), did initially predict one exceedance of the 24-hour NAAQS to which the proposed project would have more than a de minimis contribution, i.e., an impact that would trigger further modeling and evaluation under the PSD rules. The exceedance is in the immediate vicinity of the Aventine complex and is attributable primarily to existing operations at the Aventine complex and the adjacent Midwest Grain complex. This potential exceedance had previously been identified, with responsibility placed largely on two gluten dryers at Midwest Grain whose emissions are controlled with baghouses but whose stacks are subject to downwash due to inadequate height. A Construction Permit has been issued to Midwest Grain to increase the height of the stacks but Midwest Grain has not yet commenced construction of the higher stacks. Until this occurs, Aventine would have to coordinate the operation of certain units at the proposed dry mill facility with any operation of the two gluten dryers by Midwest Generation to assure that the 24-hour PM NAAQS is protected.

The analysis for ozone was conducted using a screening method developed by USEPA for PSD permitting to address the historic

one-hour ozone standard. The analysis confirms that the project will not cause a violation of the ozone air quality standard. For this purpose, information on current air quality for ozone in the region is available from two ambient monitoring stations operated by the Illinois EPA in Peoria and Peoria Heights. These show that air quality in the region complies with both the historic one-hour ozone standard and the current eight-hour ozone standard.

C. IMPACTS ON SOIL, VEGETATION AND VISIBILITY

The application addresses the potential impact of the proposed project on soils, vegetation, and visibility. The assessment concludes that the project would not adversely impact soil, vegetation or visibility. This is because the maximum air quality impacts predicted for both NOx and SO2 emissions from the project are de minimis, so that existing air quality should not be affected measurably by this project.

VI. PERMIT CONDITIONS

The conditions of the permit set forth the air pollution control requirements that the project must meet. These requirements include the applicable emission standards that apply to the project. They also include the measures that must be used and the emission limits that must be met as BACT for emissions of PM, VOM and NOx from the new facility.

The permit also establishes enforceable limitations on the amount of emissions for which the project is permitted. Limitations are set both for PM, VOM and NOx, for which the project is major, and for pollutants for which the project is not major. In addition to annual limitations on emissions, the permit includes short-term emission limitations and operational limitations, as needed to provide practical enforceability of the annual emission limitations. As previously noted, actual emissions associated with the project would be less than the permitted emissions to the extent that the facility operates at less than capacity and control equipment normally operates to achieve emission rates that are lower than the applicable standards and limitations.

The permit also establishes appropriate compliance procedures for the ongoing operation of the facility, including requirements for emission testing, required work practices, operational monitoring, recordkeeping, and reporting. These measures are imposed to assure that the operation and emissions of the facility are appropriately tracked to confirm compliance with the various limitations and requirements established for individual emission units.

VII. REQUEST FOR COMMENTS

It is the Illinois EPA's preliminary determination that the proposed project meets applicable state and federal air pollution control requirements. The Illinois EPA is therefore proposing to issue a construction permit for the project.

Comments are requested on this proposed action by the Illinois EPA and the conditions of the draft permit.